Fluoride Vol. 35 No. 1 1-4 2002 Editorial review 1

FLUORIDATION IN CHINA: A CLOUDED FUTURE

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SUMMARY: Water fluoridation in China began in 1964 in Guangzhou and was discontinued in 1983 after a 6.5-fold increase in dental fluorosis was observed with only a marginal decrease in dental caries. Other adverse findings by specialists in preventive medicine also played a role in the decision, along with recognition of the importance of other sources of fluoride intake besides drinking water.

Keywords: China, Dental caries, Dental fluorosis, Fluoridation, Guangzhou, Total fluoride intake.

INTRODUCTION

Except for the municipality of Shanghai, every province in China has areas that are afflicted with endemic fluorosis. Unfortunately, the problem is often serious and is usually difficult to prevent or correct. The major sources of fluoride ingestion are drinking water, coal burning, and brick tea.

In 1976 epidemiologists began a systematic investigation of endemic fluorosis in China. Since then much progress has been made in basic research on the biological properties and health effects of fluoride and in gaining a better understanding of various aspects of fluorosis, such as the role of total fluoride intake and the relationship between fluoride and other trace elements.

For the prevention of dental caries, a drinking water standard for fluoride of 1.0-1.5 mg/L had been widely adopted. In China the standard in the 1950s was 1.5 mg/L. In the 1970s it was lowered to 0.5-1.0 mg/L, where it has remained to date.

From 1979 to 1982 we conducted studies to determine the maximum safe level of fluoride in drinking water. This research included toxicological experiments on animals and epidemiological investigations of human populations. Long-term studies with fluoride in drinking water at 1 mg/L revealed adverse effects on bone quality and accumulation of fluoride in hair and fur of animals indicative of early or mild stages of fluorosis. Epidemiological investigations revealed that, at a fluoride level of 1 mg/L in water, the incidence of dental fluorosis in some areas was 50 percent or more. As a result of these findings we urged the Health Standards Commission to reduce the standard for fluoride in drinking water to 0.6 mg/L, but this suggestion was not adopted.

REVIEW OF RESEARCH FINDINGS

Total fluoride intake: In 1976 fluorosis was found to be widespread in Bijie Prefecture of Guizhou Province where fluoride levels in the water were quite

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low. One of us (ZDW) suggested that total fluoride intake from all sources needed to be considered and not just fluoride from water, which then was a new challenge to an old idea.

Today many investigators are re-examining fluoride standards using total fluoride intake. In 1996, Liang Chaoke proposed that standards for fluoride intake be based on whether the main source of fluoride was from coal burning or from drinking water.[1] Accordingly, for individuals 8-15 years old living in areas where coal burning is the principal source of fluoride, he suggested a maximum of 2.0 mg F/day and 2.4 mg F/day where drinking water is the main source. For persons over 15 years he suggested 3.0 mg/day and 3.5 mg/day for coal burning and water areas, respectively. On 11 January 1997 these proposals were accepted by the Health Ministry of the People's Republic of China and made effective on 1 September 1997.

Fluoridation in Guangzhou and its termination: In 1965 fluorosilicic acid was added to the tap water of Guangzhou, the capital of Guangdong Provide in SE China, to increase the fluoride concentration to 0.8 mg/L, conditional on the F concentration in the Zhujiang River water source falling below 0.3 mg/L. Ten years later, in 1975, 8-year-old children who were born after fluoridation began were given dental examinations. In comparison to adjacent control areas, the incidence of caries-free teeth had increased, and the mean level of caries had decreased. However, the incidence of dental fluorosis had increased markedly from 10.5 percent to a range of 39-66 percent, indicating that fluoride intake was too high. The concentration of fluoride in the tap water in Guangzhou was then adjusted to 0.7 mg/L, but fluoridation was continued.

A few years later, open discussions took place between dental public health advocates and opponents in preventive medicine about the pros and cons of fluoridation in Guangzhou. By 1980 new evidence had emerged seriously questioning the advisability of the procedure. Zimei Wu found that after almost 14 years of fluoridation the incidence of dental fluorosis was 78.1 percent in the Yuexiu and Zhuhai districts of Guangzhou.[2] This figure was 6.5 times higher than before fluoridation and 5.5 times higher than in the nonfluoridated city of Zhaoqing located 80 km west of Guangzhou.

Results of a subsequent 1982 dental survey of children in Guangzhou born in 1964 through 1970 as reported by Yuanzhu Guo[3] are summarized in Table 1. A comparison survey of 12-year-old children in nonfluoridated Zhaoqing is recorded in Table 2. Note that the community index of dental fluorosis on the Dean scale exceeded the recommended maximum of 0.4 for every age in fluoridated Guangzhou but was only 0.05 in Zhaoqing for children at age 12. Equally interesting is the finding that the caries incidence among the 12-year-olds was almost the same in the two cities.

Table 1. Incidence of dental fluorosis (DF) and caries among children in Guangzhou in 1982 and after 17 years of water fluoridation

Age yrs	No. ex.	No. with dental fluorosis on Dean scale[a]						Total DF (%)[b]	DF com. index	Caries ave.	Caries percent
		none	0.5	1.0	2.0	3.0	4.0				
12	65	22	26	13	3	1	0	17(26.2)	0.54	1.3	56.9
13	46	17	18	7	3	1	0	11(23.9)	0.54	1.2	46.7
14	40	13	12	11	2	1	1	15(37.5)	0.70	1.1	45.0
15	75	11	23	19	8	12	2	41(54.7)	1.21	0.9	36.5
16	76	20	22	15	11	7	1	34(44.7)	0.96	0.9	36.5
17	95	17	28	21	12	14	3	50(52.6)	1.19	1.2	49.5
18	35	6	13	8	4	3	1	16(45.7)	1.01	1.4	60.0

[a]Dean scale: 0 (none) = normal; 0.5 = questionable; 1.0 = very mild; 1.0 = mild; 2.0 = mild; 3.0 = moderate; 4.0 = severe.

[b]Questionable category not included.

Table 2. Dental comparison of 12-year-old children in fluoridated Guangzhou and nonfluoridated Zhaoqing in 1982

Location (city)	Number examined	Percent with DF[a]	DF com. index	Caries ave.	Caries percent	F^- conc. mg/L
Guangzhou	65	26.2	0.54	1.3	56.9	0.3-0.6
Zhaoqing	77	1.3	0.05	1.2	53.2	0.2-0.3

[a]Questionable category not included.

In 1980 the Epidemic Prevention Station in Guangzhou determined the total daily fluoride intake of residents of the city by using the multi-source fluoride concept introduced by one of us (ZDW). The results are summarized in Table 3. Following further evaluation and discussion, fluoridation in Guangzhou was discontinued after 18 years in 1983. Three years later it also ceased in Dongguan, a village 50 km ESE of Guangzhou, where it was initiated in 1974.

Table 3. Estimated total daily fluoride intake in Guangzhou in 1980

Group	Range: mg F/day	Mean: mg F/day
Children	2.5 - 3.0	2.7
Adults	3.5 - 4.0	3.7

In December 1990, seven years after fluoridation was discontinued in Guangzhou, a follow-up dental survey of 62 15-year-old school children appeared to indicate a lower caries rate and less dental fluorosis than in 1982. The number of decayed, missing, and filled permanent teeth per child was only 0.44, the prevalence of dental fluorosis was 21 percent, and the community index of dental fluorosis was down to 0.42. For 71 15-year-olds in the much smaller city of Fushan (water F = 0.1 mg/L), the corresponding figures were 2.20, 2.8 percent, and 0.08.[4]

AFTERMATH

At present there is no water fluoridation in China, but the debate has continued. In 1992 an advocate in Beijing proposed that fluoridation be reinstated. At an open forum this proposal was defeated, but that did not end the matter. In October 1999, 20 members of the news media competed in publicizing the issue under the heading: "China will Implement Universal Fluoridation in the Year 2000 to Prevent Caries." However, no further fluoridation took place, casting doubt on the evidence in the media publicity.

In 2000 a comprehensive report dealing with the history of fluoridation, the etiology, epidemiology, and prevention of dental caries, health issues and standards for fluoride, and total fluoride intake was published in Guizhou.[5] It is our hope that the information in this report will be carefully weighed before any further attempt is made to re-introduce fluoridation in China.

This paper is based on a poster presentation given at the XXIVth Conference of the International Society for Fluoride Research, Otsu, Japan, 4-7 September 2001 (Program Abstract P-18).

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Editorial Office: 727 Brighton Road, Ocean View, Dunedin 9051, New Zealand